

BRADY FIRE SERIES

EXHIBIT 2

KIRK'S FIRE INVESTIGATION

EIGHTH EDITION

David J. Icové

Gerald A. Haynes



 Pearson

PREFACE TO THE EIGHTH EDITION

More has changed in the last year in the field of fire investigation than in all the years since the 1969 publication of the first edition of *Fire Investigation* by Dr. Paul L. Kirk and the 2004 publication of the first edition of *Forensic Fire Scene Reconstruction*. Dr. Paul L. Kirk was a professor of biochemistry and criminalistics at the University of California at Berkeley, but it was his specialty of microchemistry that focused his attention on physical evidence and its analysis. In 1953, he wrote the landmark text, *Crime Investigation*, and maintained a private criminalistics consulting practice where he became involved in a wide variety of fire and explosion cases. He published *Fire Investigation* in 1969 as the first textbook on fire investigation written by a scientist rather than a fire investigator. Dr. Kirk remained in charge of the criminalistics program at Berkeley until his death in 1970 and launched the careers of many criminalists who now practice around the world. His concern with using science to solve the puzzles of fires and explosions presaged the current emphasis on using the scientific method to investigate fires by more than 30 years. It is in honor of Dr. Kirk's pioneering work in bringing science to fire investigation that his name remains included in the title, *Kirk's Fire Investigation*, and the spirit, of this text. No longer is the investigation of fires just limited to inspecting the ruins, asking questions of the witnesses, and applying basic common sense and observations to determine the fire's origin and cause. Fire investigators must now keep in step with the rapid changes in the forensic sciences, the innovations in fire scene documentation, and challenges in the court stressing precise defensible expert testimonies.

Dr. John D. DeHaan became the author of *Kirk's* in 1980, at the request of the then publisher, John Wiley & Sons. His involvement with international fire, explosion, and forensic professional organizations provided a wide variety of knowledge and the opportunity to share techniques and information with many renowned experts. His Ph.D. research was on the development of layers of flammable liquid vapors (University of Strathclyde, 1995). After more than 30 years however, Dr. DeHaan felt it was time for a newer generation of authors with skills in the engineering applications required of today's investigators to take the lead.

The eighth edition of *Kirk's Fire Investigation* blends the seventh edition of *Kirk's* with the third edition of *Forensic Fire Scene Reconstruction*. The design of this new textbook meets the emerging forensic challenges. *Kirk's* still ranks as the foremost authoritative text for training as well as an expert treatise for fire investigation professionals. It also serves as a bridge textbook providing interoperation of the concepts presented in the latest editions of the National Fire Protection Association (NFPA) *Guide for Fire and Explosion Investigation* (NFPA 921), *Standard for Professional Qualifications for Fire Investigator* (NFPA 1033), and related standards of care.

The premier aspect of *Kirk's* is that it maintains its role as the leading peer-reviewed and widely cited expert treatise in the fire investigation field. Concepts and investigative techniques presented are supported by peer-reviewed references and have already gained general acceptance in the fire and explosion investigation field. Notwithstanding, *Kirk's* ability to assimilate and interpret emerging techniques typically outpaces the publication of NFPA 921 and other standards of care, and can be safely relied upon by expert witnesses.

Because forensic fire scene documentation is emerging as the cornerstone in nearly all judicially contested investigations, modest reconstructive efforts such as repositioning furniture and other post-fire artifacts into pre-fire positions no longer suffice. Therefore, during scene documentation, today's fire investigator must possess skill in scientifically based fire pattern analysis and must employ analytical methodologies based on expert interpretation of discernible patterns and fire dynamics principles.

Chapter 10, "Fire Testing," describes how despite governmental regulations, fires in which fabrics are the first materials to be ignited are still a very common occurrence. The chapter discusses the nature of common fabrics and upholstery materials and their contributions to both ignition hazard and fuel load in current studies.

Chapter 11, "Arson Crime Scene Analysis," reviews the techniques used in the analysis of arsonists' motives and intents. It presents nationally accepted motive-based classification guidelines along with case examples of the crimes of vandalism, excitement, revenge, crime concealment, and arson-for-profit. The geography of serial arson is also examined, along with techniques for profiling the targets selected by arsonists.

Chapter 12, "Fire Deaths and Injuries," provides an in-depth examination of the impact and tenability of fires on humans. The chapter examines what kills people in fires, namely their exposure to by-products of combustion, toxic gases, and heat. It also examines the predictable fire burn pattern damage inflicted on human bodies and summarizes postmortem tests and forensic examinations desirable in comprehensive death investigations.

The Appendices contain a short refresher lesson on scientific notations and calculations.

Peer Reviewers

Peer review is important for ensuring that a textbook is well balanced, useful, authoritative, and accurate. The following individuals, agencies, institutions, and companies provided invaluable support during the peer-review process in the present and past editions of *Kirk's Fire Investigation* and *Forensic Fire Scene Reconstruction*.

Dr. Vytenis (Vyto) Babrauskas, Fire Science and Technology Inc., San Diego, California

John Bailot, MPA, IAAI-CFI, EMT-P, Adjunct Faculty, St. Louis Community College – Forest Park, St. Louis, Missouri

David M. Banwarth, P.E., Fire Protection Engineer, David M. Banwarth Associates, LLC, Dayton, Maryland

Richard L. Bennett, Associate Professor of Fire Protection & Emergency Services, The University of Akron, Akron, Ohio

Dr. Elizabeth C. Buc, P.E., CFI, Fire and Materials Research Lab, LLC, Livonia, Michigan

Dr. John L. Bryan, Professor Emeritus, University of Maryland, Department of Fire Protection Engineering, College Park, Maryland (deceased)

Charlie Butterfield, M. Ed., NRP, CFO, Professor, Fire Service Administration Program, Idaho State University, Pocatello, Idaho

Brian Carlson, MS, Fire Science, University of Cincinnati, Ohio

Guy E. "Sandy" Burnette, Jr., Attorney, Tallahassee, Florida

Steven W. Carman, MS, Fire Protection Engineering, IAAI-CFI, Owner, Carman & Associates Fire Investigation, Grass Valley, California

Jody Cooper, IAAI-CFI, CVFI, Owner/investigator, JJMA Investigations LLC, and Instructor, Oklahoma State University, Poteau, Oklahoma

Carl E. Chasteen, BS, CPM, FABC, Chief of Forensic Services, Florida Division of State Fire Marshal, Havana, Florida

Robert F. Duval, National Fire Protection Association, Quincy, Massachusetts

Mark Fyffe, MPA, BS, Fire and Safety Engineering, Adjunct Professor, University of Cincinnati, Ohio

Christopher Gauss, IAAI-CFI, Captain, Baltimore County Fire Investigation, Towson, Maryland

short and usually interrupt power before a fire can be started. High-resistance connections, on the other hand, can create enough heat for long periods of time without drawing enough current to trip protective devices. These long-term heat sources are much more likely to ignite ordinary fuels than momentary short-circuit arcs. Examination of the fuse box or circuit breaker panel to determine which circuits have been tripped may be helpful in eliminating areas and the circuits that serve them.

Wire within a metal conduit will rarely short except when the conduit is heated sufficiently by an external fire to char the wire's insulation. If a short circuit is formed within a conduit from any cause, it must be a high-energy one to penetrate to the exterior and start a fire, although such events are not unknown [involving unprotected circuits, high-current applications (>40 A), failed overcurrent protection devices, or three-phase wiring]. Starting a fire requires that the conduit itself be heated. In a very rare instance, it might be heated above the ignition temperature of some material in contact with it, which could become ignited. The high heat conductivity of the metal conduit is actually a very good protection against starting of fires from wires enclosed in the conduit.

Zinc die casts used in conduit connectors have relatively low melting points and will melt in a fire surrounding the conduit. The heat of the fire may also remove the insulation, so that molten zinc will contact copper. When this occurs, the zinc and copper will form brass. Either the molten zinc or the brass formed may complete a short circuit between wires not previously in contact. This effect is not a cause of the fire but the result of an external fire. The presence of brass within a conduit or spilled from a broken conduit is good evidence of an external fire that led to its formation.

7.2.4 ARC MAPPING

The plotting of electric arcing in electrical wiring found at a fire scene is valuable in testing hypotheses about possible areas of origin. A map of arc faults can be overlaid on diagrams of other indicators. If the electric circuit involved can be traced back to its power source, the location of the arc fault (which caused the overcurrent device to trip or the conductors to part) farthest from the power source is likely to be the area closest to the origin. This assumes that the wiring was equally exposed to the fire. Wiring concealed in walls will be affected much later than exposed power cords. Arc-fault mapping is not used to establish whether an electrical fault caused the fire but as an indicator of area of origin. For guidance on arc mapping, refer to the latest edition of NFPA 921, pt. 9.11.7 (NFPA 2017).

7.2.5 APPLIANCE CONDITION

The appearance of an appliance that started a fire is different from that of one that was in a fire, but the differences can be difficult to spot. The external fire will damage any appliance by burning the enamel, discoloring and corroding the steel, and otherwise distorting or warping it. If the fire is external to the appliance, whatever damage it suffers will show uniformity, or at least agreement, with the fire patterns on walls, furniture, or other appliances in the vicinity. The appliance is much less likely to be damaged internally if the cabinet or housing is noncombustible. If the appliance started the fire, it will be damaged more internally than externally and will usually have some local damage or effect that is quite distinct from the general damage pattern. Because fires are easily blamed on a faulty oven or a maladjusted furnace, incendiary fires are sometimes ignited in the vicinity of such appliances to throw the investigator off the track.

In most such instances, the arsonist will pour a flammable liquid around and under the appliance and then ignite it. In such instances, it is normal for the liquid to penetrate below the appliance and to give a burn far below that which is possible for the appliance itself. Gas appliances and fireplaces will usually lead to fire above the base level of the normal combustion, not to a region under the floor. Burns below this level of support may be traceable to a failure or defect of the gas supply or firebox or to improper installation.